4.0 WSSRAP

The chemical plant area of the Weldon Spring site is located about 2 miles southwest of the junction of Missouri (State) Route 94 and U.S. Route 40/61 and the community of Weldon Spring (Figure 3). The site contained 44 buildings and support structures, as well as remnants of a railroad system, four raffinate pits, and two small ponds.

In April 1941, the U.S. Department of Army acquired about 17,000 acres of land in St. Charles County, Missouri, to construct the Weldon Spring Ordnance Works. From November 1941 through January 1944, the Atlas Powder Company operated the ordnance works for the Army to produce trinitrotoluene (TNT) and dinitrotoluene (DNT) explosives. The ordnance works began operating again in 1945 but was closed and declared surplus to the Army needs in April 1946. By 1949, all but about 2,000 acres had been transferred to the state of Missouri and the University of Missouri. Except for several small parcels transferred to St. Charles County, the remaining property became the chemical plant area of the Weldon Spring site.

The U.S. Atomic Energy Commission acquired 205 acres of the former ordnance works property from the Army by permit in May 1955, and the property transfer was approved by Congress in August 1956. An additional 15 acres was later transferred to the AEC for expansion of waste storage capacity. From 1954-1957, the AEC constructed a feed materials plant - now referred to as the chemical plant - on this property for processing uranium and thorium feed stocks into metal and intermediate products. This facility replaced a more limited plant of similar operational capability located in St. Louis (Dastrahan Street). The feed materials plant was operated for the AEC by the Uranium Division of Mallinckrodt Chemical Works from 1957 to 1966. Product quantities were protected for national security purposes at that time and, therefore, were not a matter of public record. These product quantities and the operations that produced them were later declassified but no public announcement was ever made of plant material balances. Between 1958 and 1964, four raffinate pits were constructed in the southwest portion of the site to contain process wastes from the plant. The facility was designed specifically to process uranium mill concentrates (yellow cake) produced elsewhere in the United States and Canada. These materials were shipped to Weldon Spring Site for sampling to determine payment. Fractions of the total mill concentrates were processed through chemical treatment operations. Other fractions, after sampling, were shipped to other DOE facilities for further processing.

The employment at the site for the Uranium Division numbered around 600 employees. Included in that number was 80 employees that were technical employees assigned to various production, technical and managerial positions. The estimate of those personnel that would have handled the materials is estimated as around 300.

From June 1957 through December 1966, four types of nuclear material were processed in the DOE owned Weldon Spring Chemical Plant. These materials were: (1) natural uranium, (2) depleted uranium, (3) slightly enriched uranium, and (4) natural thorium.

Natural Uranium: Natural uranium was received as continental ore concentrates which were refined to extract the uranium, after which the uranium was converted to various compounds and metal forms and shipped off site. Processing of natural uranium was a continuous operation during the life of the plant.

Depleted Uranium: Uranium depleted in U-235 isotope below its natural isotopic abundance ratio was received and processed on an intermittent basis. This form of uranium was used primarily in product development activities and flow sheet improvements. Thus, use was confined primarily to pilot plant activities, and waste generation was minimal.

Slightly Enriched Uranium: Uranium enriched to one percent or less U-235 by weight was also received and processed on an intermittent basis. This type of uranium was typically received in the form of scrap metal or residues. The uranium contents were recovered, processed to various chemical forms, and shipped off site. The coefficient of variation about the values assigned to all flows of this type of material was slightly greater than that for natural uranium primarily because of the heterogeneous nature of receipts.

Natural Thorium: Natural thorium was received and processed on an intermittent basis in the refinery. Thus, discards were, for the most part, limited to releases to operating raffinate pits. The coefficient of variation about the values assigned to all flows of this type of material form was much greater than that for natural uranium because of accountability requirements then in existence for this material and separateness of all handling operations to avoid commingling of products. The natural thorium inventory is not discussed in detail within the context of the DOE Recycled Uranium Project Report.

Natural uranium processing accounted for more than 97% of the nuclear materials throughput. Total material balance closures for natural; uranium, depleted uranium, and slightly neriched uranium were 99.94%, 100%, and 99.27%, respectively. Of the discards, approximately 75% went to the raffinate pits.

Discharges to stacks and sewers account for the remaining discards. As far as can be determined, it appears all plant processes operated efficiently and all materials were well accounted for with only minimal variances.

During operations, uranium feed stocks were processed to produce uranium metal; intermediate forms in the chemical processing operation included uranium dioxide, uranium trioxide and uranium tetrafluoride. An average of 16,000 tons of uranium- containing material was processed per year. The Weldon Spring Site processed materials mainly from 1963 through 1967. A small amount of thorium ore concentrate was also processed at the plant. These processes generated several chemical and radioactive waste streams, which were piped to the raffinate pits. The solids settled to the bottom of the pits, and the supernatant liquids were decanted to the plant process sewer that drained off-site to the Missouri River.

The plant was reacquired by the Army in 1967 and initiated decontamination and dismantling operations in 1968 to prepare for conversion to a herbicide production facility. The facility was never converted to this production due to costs and efforts to meet extant radioactive contamination limits. In FY-1986 DOE assumed custody of the facility. The facility was placed on the NPL in July 1987 (quarry) and February 1990 (chemical plant). The site has completed extensive remediation including the establishment of an onsite disposal facility.

The following were the main facilities at the Weldon Spring Site:

Building 101 Sampling Plant: Designed to process approximately 75 tons of low-assay uranium ore concentrates per day. Housed equipment and facilities for drying, grinding, screening, blending, and sampling ore concentrates and process residues. Incoming ore concentrates and residues were stored in drums on the concrete pad. This facility began operation in June 1957.

Area 102 A & B Refinery Tank Farm: Provided facilities for unloading, storing, and transferring liquid process material that were required in the refinery operation and were supplied or handled in tank-car and tank-truck quantities. This facility began operation in June 1957.

Building 103 Digestion and Denitration: The northern digestion section received uranium ore concentrates which, after digestion were transferred as a slurry to Building 105 where the solvent was purified by extraction. The middle denitration section received the purified uranium nitrate solution, which was denitrated to yield uranium nitrate solution, which was further denitrated to yield uranium trioxide (UO_3). During later years, thorium products were also processed in this building.

Building 104 Lime Storage: Facility for storing lime.

Building 105 Extraction: Previously used for producing a highly purified uranyl nitrate hexahydrate (UNH) solution by means of extraction columns, process vessels, evaporators, and tributyl phosphate and hexane reaction tanks.

Building 106 Refinery Sewer Sampling: Used as a sampling station for process waste streams.

Building 108 Nitric Acid Plant: Used for recovering and reconcentrating nitric acid and oxides of nitrogen.

Building 109 West Drum Storage, Building 110 East Drum Storage: Used to store drums containing ore concentrates and process residues.

Building 201 Green Salt Building: Used for converting uranium trioxide (UO_3) to uranium dioxide (UO_2) and uranium tetrafluoride (UF_4). This facility began operation in February 1958.

Building 202 A & B Green Salt Tank Farm: Used for tank car unloading and storage of hydrofluoric acid (HF) and ammonia.

Building 301 Metals Building: Used for converting uranium tetrafluoride (UF_4) to uranium metal. This facility began operation in April 1958.

Building 302 Magnesium Building: Facility used for storage of magnesium.

Pad 303: Served as a material storage pad.

Building 401 Steam Plant: Steam generating plant including coal conveyor and coal yard.

Building 403 Chemical Pilot Plant: Designed to house pilot-plant equipment for testing modifications to processing carried out in the digestion, extraction, and denitration areas. Later uses also included processing of scrap metals and production of thorium.

Building 404 Metal Pilot Plant: Provided facilities for metal processing studies, ceramic work, and metal testing; also housed the metallurgical pilot plant.

Building 405A & B Pilot Plant Maintenance Building: 405A was a small shop and storage building used to store spare pilot-plant equipment. The dust collectors and vacuum cleaning system for Buildings 403 and 404 were located on Pad 405B.

Building 406 Warehouse: Served as a warehouse and office area.

Building 407 Laboratory: Used as an analytical chemistry laboratory.

Building 408 Maintenance and Stores: Contained numerous maintenance shops, office area, garage, receiving and shipping area, decontamination room, and a large storage area.

Building 409 Administration Building: Contained offices for administrative staff.
Building 410 Services Building: Contained the plant security office, health and safety office, kitchen, dining room, laundry facility for contaminated clothing, and clean and contaminated locker rooms with shower facilities.

Building 412 Electrical Substation: Substation for electrical supply.

Building 413 Cooling Tower and Pump House: Cooling tower and pump house.

Building 414 Salvage Building: Served as a salvage shop and equipment storage space.

Building 415 Process Incinerator: Incinerator for process materials.

Building 417 Paint Shop: Served as the paint shop.

Building 426 Water Tower: Used for water storage (elevated water storage tank).

Building 427 Primary Sewage Treatment Plant: Served as the primary sewage treatment plant for the site.

Building 428 Fuel Gas Plant: Storage facility for fuel gas.

Building 429 Water Reserve Facilities: Used for water storage (pumphouse and ground storage tank).

Building 430 Ambulance Garage: Used as an ambulance garage.

Building 431Laboratory Sewer Sampler: Used as a sampling station for process waste streams.

Building 432 Main Sewer Sampler: Used as a sampling station for process waste streams.

Building 433 - 436, 438 Storage Buildings: Used as a warehouse and storage facility.

Building 437 Records Retention Building: Facility used for storage and retention of records.

Building 439, 443 Fire Training and Storage Building: Facility used for fire training purposes and storage.

Building 441 Cylinder Storage: Facility used for storage of UF_6 cylinders.

On site railroad system: Served as rail access to the site during past construction and operations. Installed to deliver raw materials to and remove product from the plant.

Full operations of the total plant was achieved in late 1958 and continued until its shutdown in December 1966.

REFERENCES:

1. U.S. DOE ORO, July 1986, "Historical Nuclear Materials Balance Report For The Former AEC Owned Weldon Spring Chemical Plant, Weldon Spring, Missouri," DOE/OR-872, DOE-ORO, Oak Ridge, TN.

2. TID-5886, "Expansion Program at St. Louis Area – Project No. 224-5066A," USAEC, October 1960.

3. Pamphlet, "Weldon Spring – An Introduction," Mallinckrodt Chemical Works, Circa 1965.